
Department of Philosophy

PHIL 421/PHIL 522: MODAL LOGIC/TOPICS IN LOGIC — *Katalin Bimbo*

[Course description — Winter term (2019)]

Modal logics were the first formal logical systems to be introduced at the beginning of the 20th century that utilized non-truth-functional connectives. C. I. Lewis introduced strict implication in order to avoid problems associated with material implication, and he proposed five axiomatic calculi. (Two of Lewis's logics — **S4** and **S5** — turned out to be long-lived.) Strict implication (as a basic modal notion) has been replaced by notions such as “necessity” (\Box) and “possibility” (\Diamond). In the middle of the 20th century, considerable progress was made in research on proof systems for modal logics and on their semantics. Gödel introduced an *axiomatization* of **S4** as an extension of 2-valued logic, and Kripke introduced a *relational semantics* for several normal modal logics.

The connectives \Box and \Diamond of a modal logic may be interpreted through concepts other than *alethic* ones — including *deontic* and *tense* notions. These interpretations provide frameworks in which arguments that are of importance in philosophy in general can be made precise. However, other interpretations and further modal connectives have been introduced too. For example, *dynamic logic* is a highly successful logic in computer science; it is capable of formalizing reasoning about programs.

Modal concepts may be investigated in the context of logics that are not 2-valued. Connections between modal logic and *intuitionistic logic* were discovered in the 1930s, and modal connectives have been introduced into *relevance logics* in the 1960s. A relatively new logic from the 1980s is *linear logic*, which has strong connections to category theory and can be interpreted in a wide range of ways.

The course will start with some basics — such as the language of a modal logic, proof systems, semantical interpretations — in order to establish a common ground. Then we will look at concrete modal logics, starting with a handful of well-known logics (**K**, **T**, **B**, **S4** and **S5**). Some of the other logics that we will scrutinize will include temporal, dynamic, relevance and linear logics. These logics have compelling applications, and they have various intriguing (meta-)properties, some of which we will prove in the course.

[The formal prerequisite for the Phil 421 course is Phil 220. The prerequisite may be waived in certain cases upon request. Phil 522 has no official prerequisite.]

Time: M, W, F 13:00 pm–13:50 pm

Texts: Blackburn, P., De Rijke, M. and Y. Venema, *Modal Logic*, Cambridge University Press, 2001. (recommended) Other texts will be linked in the e-classroom.

For **further information**, please contact the instructor at <bimbo@ualberta.ca>

The (official) **course outline** is available in the e-classroom during the course.
